lators. Improved processes of manufacture have in a great measure removed these defects, but even the best lights will still occasionally flicker.

The red and yellow rays have the greatest penetrating power; and for this reason an oil-light, which is rich in these rays, can be seen farther in foggy weather than an electric light of *equal candle-power*. But the electric light can be made so much more powerful than the best oil-light, that this deficiency can be more than made up; still, it must be borne in mind when the candle-powers of the two lights are compared.

When the French system was adopted, the incandescent electric light had not left the domain of experiment; and even now its luminous intensity is very much less than that which can readily be obtained from an arc-light of moderate dimensions. It possesses, however, the element of remarkable fixity, and is rich in red and yellow rays. No light could be better for a light-house, if it can be produced cheaply, have sufficient luminous intensity, and be made reliable. It will, moreover, dispense with the somewhat complicated and expensive regulators.

It is in this line that the Light-house board of the United States is about to make experiments, and the results obtained will have great interest for the whole world.

David Porter Heap.

GEOLOGICAL NOMENCLATURE AND COLORING.

The following stratigraphical divisions have been provisionally adopted by the international commission of the geological map of Europe. The colors placed against them are those proposed by the directors.

1. Gneiss and protogine. Bright rose-red.
2. Crystalline schists (mica schists, talc and chlorite schists, amphibole schists, and foliated gneiss). Medium rose-red.
3. Phyllites (argillaceous schists, urthonschiefer). Pale rose-red.
4. Cambrian (all fossiliferous beds below the Llandeilo flags; primordial fauna, Taconic). Reddish gray.
5. Silurian, lower fauna (second of Barrande). Dark silk-green.
6. Silurian, upper fauna (third of Barrande). Light silk-green.
7. Devonian, lower. Dark green-brown.
8. Devonian, middle (limestone of the Eifel). Medium green-brown.
9. Devonian, upper. Light green-brown.
10. Carboniferous, lower (culm, mountain limestone, etc.). Blue-gray.
11. Carboniferous, upper (houillier, millstone-grit, etc.). Gray.
12. Permian (dyas), lower (rothliegendes, etc.). Burnt sienna.
13. Permian (dyas), upper (zechstein and equivalents). Sepia.
14. Trias, lower (grès bigarré). Dark violet.
15. Trias, middle (muschelkalk). Medium violet.
16. Trias, upper (keuper and equivalents). Light violet.

16′. *Rhetic*, provisionally (haupdolomit excluded).

17. Jurassic, lower (lias). Dark blue.
18. Jurassic, middle (dogger, kellovien included). Medium blue.
19. Jurassic, upper (malm with tithonic and Purbeck). Light blue.
20. Cretaceous, lower (Neocomien and Wealdian). Dark green.

20′. *Gault*, provisionally.

21. Cretaceous, upper (from the cenomanien). Light green.
22. Eocene (nummulitic, etc.). Orange-yellow.

22′. *Flysch*, provisionally.

23. Oligocene (with the aquitanien). Dark yellow.
24. Miocene (mollasse). Medium yellow.
25. Pliocene. Light yellow.
26. Diluvium. Naples yellow.
27. Alluvium. White.

The subdivisions, 'Rhetic,' 'Gault,' and 'Flysch,' whose affinities are doubtful, will be figured separately in the preparatory work; so that they can finally be joined either to the upper or lower formation, according to the decision reached by the commission of nomenclature.

INDIAN RELICS FROM NEW BRUNSWICK.

Though Indian relics of the ordinary type, such as arrow-heads, axes, gouges, celts, etc., are of common occurrence in this region, as elsewhere, it is extremely rare to find any articles showing other features than those of mere utility; while remains of pottery, so far as I am aware, have, until recently, been entirely unknown. During the last summer, however, my attention was directed to a locality which is one of some interest, not only as containing undoubted relics of this character, but also as illustrating a somewhat unusual mode of occurrence.

The locality in question is that of a small stream or 'thoroughfare' connecting two sheets of water known as Grand and Maquapit Lakes, being the two principal members of a series of lakes and streams covering a considerable area in the central coal-basin of New Brunswick, and tributary to the river St. John. Both

shores of this thoroughfare are low, that intervening between it and the St. John being a mere marsh subject to overflow by the spring freshets; and it is in the soft muds forming the bank of the stream, and thus annually submerged, that the relics in question are obtained.

These are in the form of broken fragments of pottery, of which the largest obtained by me was about two by two and a half inches, and, although not sufficiently perfect to give any definite idea of the form or size of the vessels of which they once formed a part, reveal very clearly, by their composition, texture, and ornamentation, their true nature. As a rule, they are quite firm, looking as if made up of a granular admixture of clay and fine sand, through which, in many specimens, are scattered numerous and rather conspicuous fragments of a lustrous black mica; the whole being hardened, if not vitrified, by heat. The outer surface is usually covered with a reddish or dark-brown glaze, which is less coarse than the material beneath; and upon this surface are stamped or impressed numerous indentations variously arranged in series of parallel, forking, or decussating lines. In one instance only could any thing like definite form be recognized; this being a well-rounded rim, or margin, striped on either side, of what appears to have been a shallow hemispherical bowl, or basin, of some six inches in diameter. During the extreme low water of summer, such fragments may be readily obtained lying on the surface of the hardened mud-beds, but at other times are to be had only by wading.

With these remains of ancient pottery has been found a great variety of stone implements, some of exceptionally perfect design and workmanship, and in two instances elaborately ornamented; while at short distances along the shore, and laid bare by the ploughing action of the ice in spring, are small heaps of flint-chips of all shapes and sizes, with, not unfrequently, broken pebbles or bowlders of quartz from which these have been derived.

The locality is one eminently fitted by its position for the temporary or permanent occupation of the aboriginal tribes, giving easy access by water not only to the St. John River, but to an extensive lake-region, which must have abounded then, as it still does, in game of various descriptions. It has, indeed, been a favorite camping-ground with the natives ever since the time of the first settlement of the country by the Europeans. A curious instance of the contact of the two races has been observed in the finding, during the ploughing of a field, several feet below the surface and not far from the thoroughfare above described, of a large copper caldron, or kettle, evidently of French manufacture, but containing within, besides a quantity of moose-hide, a variety of colored glass beads, some arrow-heads, and a single human molar tooth.

L. W. BAILEY.

Fredericton, N.B., March 4, 1883.

THE PROPERTIES OF CARDIAC MUSCLE, AND THE NATURE OF THE ACTION OF THE VAGUS NERVE UPON THE HEART.

WE printed recently (SCIENCE, No. 2) an account of the researches of Engelmann upon the rhythmic properties of cardiac muscular tissue. Almost simultaneously with the appearance of Engelmann's paper, Gaskell read before the Cambridge (Eng.) philosophical society a communication on the same subject, which has since been published in the proceedings of the society (vol. iv. 277, 1882). Gaskell independently arrives at the same general conclusion as Engelmann in regard to the rhythmical properties of cardiac muscle, but adds much that is new on this and other points. Researches on the hearts of frogs and tortoises, previously published, had led him to the following conclusions: 1°, The beats of the heart represent peristaltic contractions, which start at the venous sinus, and thence travel over the heart; 2°, The peristaltic nature of these contractions is obscured by the fact, that the wave of contraction passes along a tube which is not of the same calibre or of the same properties throughout, consequently the systoles of certain parts (auricles, ventricles) which have bulged out and become prominent, or which by differentiation of structure in the course of development have gained the power of more rapid or forcible contraction, being most conspicuous, give the impression of separate and successive contractions; 3°, Between sinus and auricle, and auricle and ventricle, in these animals, is a connecting band of muscular tissue of feeble contractility and slow conductivity. A systole started in the sinus is thus separated by an apparent interval from the auricular contraction, and this in turn from the ventricular. Gaskell had further proved that one could artificially produce in any region of the heart a zone of slow conductivity, corresponding to the natural sino-auricular or auriculo-ventricular boundaries. If a clamp, for example, be closed not too tightly around the ventricle, then a pause occurs between the contraction of the base and of the apex of that division of the heart. In the tortoise, one then gets, added to the usual succeeding phases of the heart-beat, sinus systole, auricle systole, ventricle systole, — an additional one, due to the separation of the ventricular systole into two distinct contractions, — one of its base, followed, after an interval, by that of the apex. If the clamp be still further tightened, only one contraction of each pair exhibited by the base passes on to the apex of the ventricle; on further tightening, one in three, one in four, and so on, until the block caused by the clamp becomes complete.

The above experiment serving to show how easily, by differences in the conductivity of certain zones of the heart, a primitively continuous peristalsis may be turned into apparently distinct beats of various regions, each separated by an interval from that of the heart-chamber preceding it, the question arises, What is the source of the primitive contraction starting from the venous sinus? Does it lie in nerve-cells, or in the possession by the sinus of muscular fibres, which have a greater tendency than those elsewhere in the heart to exhibit apparently spontaneous rhythmic contractions? Observations on the heart of the tortoise strongly support the latter view, as they show that any section of the heart will, if left to itself, sooner or later contract automatically; the difference in this regard between the venous sinus and the tip of the ventricle is one of degree, and not of kind. The isolated sinus begins beating at once, the auricle a little later, the ventricle later still, and a strip cut out of the tip of the latter only after about four hours. Once the beats in any division commence, they become rapidly more and more regular and powerful, and then continue uniformly for, in some cases, more than twenty-four hours. These facts seem to show that all parts of the tortoise-heart are spontaneously rhythmically contractile, but that the spontaneity is most marked in the sinus, and less and less prominent as the apex of the ventricle is approached. The latter, however, contains no ganglion-cells; and, as we can pass back by gradual steps from its properties to those of the